Remarks

General

The attached substitute specification is complete with descriptions, claims, abstract, and drawings, and has been amended to reflect the following changes:

1) The length of the Abstract has been reduced to within 150 words.

2) All pages are now properly labeled with page numbers.

3) Known typographical errors have been corrected.

Claim 7 - 9, 13, 22, 24, 28, 29, 36, 37, 39, 40, 42, 46, 48, 49, 51, 53, 54 are pending. Claim 1 - 3, 6, 17, 19, 27, 30, 31, 45 are currently amended to define the invention more precisely and to correct typographical errors. Claim 4, 5,10 - 12,14,15,16,18, 20, 21, 23, 25, 26, 32 - 35, 38, 41, 43, 44, 47, 50, 52, 55, 56 have been cancelled.

Background information – Fresnel lens and zone plate modulator are different optical devices

Prior to discussing the objection to rejections, the Applicant will first provide the essential background information distinguishing the novelty of the present invention and its unobviousness over the cited references.

A Fresnel lens and a zone plate modulator are different optical devices. They have very different physical structural designs, and possess substantially different optical properties.

– ***Fresnel zone plate/Fresnel lens***

As shown in Figure 1 of this paper, a Fresnel zone plate (or a Fresnel lens) is a *static*, *fixed* lens. A Fresnel lens can not change (or modulate) its optical property, such as the output intensity, with an external control means.

– ***Zone plate modulator***

In contrast, A zone plate modulator is a *dynamic* optical device. It is a *spatial light modulator that is also capable of focusing light beams*. Therefore it can change its optical properties, such as the intensity at its focal point, via external control means, preferably a voltage. Compared to Figure 1, the zone plate modulator as shown in Figure 2 of this paper has a more complicated structure.

It is this physical structure of the zone plate modulator that makes it possible to both **focus** light and to **modulate** the output intensity proportionally by a single device. Such a task is *not* possible with a Fresnel lens.

The Objection to the claim rejection as being anticipated under § 102 by Smith

Claims 1, 5-9 were rejected under 35 U.S.C. 102(b) as being anticipated by Smith (US Pat. No. 5,900,637).

The original maskless lithography system taught by Smith (US Pat. No. 5,900,637) is "a maskless lithography arrangement 10 in accordance with the invention which includes an array of **Fresnel zone plates** 102 configured on (110) silicon substrate (not shown)." (quoted from Line 49, Column 3, US Pat. No. 5,900,637). A Fresnel zone plate is a static, *fixed* lens, and can not change its optical property with an external control means. In contrast, the optical systems disclosed by the Applicant comprise of an array of **zone plate modulators** which are dynamic spatial light modulators that are also capable of focusing lights.

The novel physical structure, along with all the limitations, of the zone plate modulators is **positively recited** in the independent claims to distinguish over Smith under Section 102. The pending claims 1, 6-9 contain limitations and elements not disclosed by the patent issued to Smith (US Pat. No. 5,900,637). Therefore these claims overcome the rejection over the reference.

Reconsideration of this rejection is requested.

The Objection to the claim rejection as being anticipated under § 102 by Gil et al.

Claims 1, 3- 5, 7-9 were rejected under 35 U.S.C. 102(e) as being anticipated by Gil et al (US Pub. No. 2004/0124372).

The original maskless lithography system taught by Smith (US Pat. No. 5,900,637) can not be readily used to generate arbitrary patterns due to its *inability to modulate* the intensity of light beams at each Fresnel zone plate in the array of Fresnel zone plates. Realizing the shortcomings of the original system design, a follow-up patent application (US Pub. No. 2004/0124372) was

filed by the same research group (Gil et al.). In the new maskless lithography system, "an array of *individually selectable sources* 16 is also provided on a support substrate 18 such that each source is aligned with one of the *focusing elements 10*." (Paragraph [0013], and also element 16 of Fig. 1, and Fig. 2, US Pub. No. 2004/0124372). As stated, the new maskless lithography system taught by Gil et al. is again based on **fixed focusing elements** including various types of fixed Fresnel lenses. The modulation of the light beam intensity at each *fixed* focusing element is accomplished by using a new element, *the individually selectable sources*.

In contrast, the optical systems disclosed by the Applicant comprise of an array of **zone plate modulators** which are dynamic spatial light modulators that are also capable of focusing lights.

The physical structure, along with all the limitations, of the zone plate modulator is **positively recited** in the independent claims to distinguish over Gil et al. under Section 102. The pending claims 1, 3, 7-9 contain limitations and elements not disclosed by the patent application (US Pub. No. 2004/0124372),

filed by Gil et al. Therefore these claims overcome the rejection over the reference. Reconsideration of this rejection is requested.

The objection to claim rejection as being unpatentable under §103 (a) over the patent application filed by Gil et al.

Claims 1 - 56 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gil et al. (US Pub. No. 2004/0124372)

As mentioned previously, the pending claims by the Applicant contain limitations and elements not disclosed by the patent application, filed by Gil et al (, US Pub. No. 2004/0124372). In addition, the new maskless lithography system taught by Gil et al. is also not operative without additional optical elements. The specification says that " each source is *aligned* with one of the focusing elements 10" (Paragraph [0013], US Pub. No. 2004/0124372). The authors failed to disclose how to align each source to each focusing element. In practical world, the outputs from many types of light sources such as LEDs or laser diodes are highly divergent. The only way to align each source to each

focusing element is by imaging the array of individually selectable sources onto the array of the focusing elements through an imaging/relay lens.

In their new maskless lithography system, Gil et al. taught the approach of using **discrete elements** of focusing lenses, modulators (or individually selector light sources), and imaging/relay lens. This approach has many problems such as being complex, inefficient, bulky, and susceptible to environmental effects. These problems are not recognized, nor mentioned by the prior art. Contrary to the teaching by Gil et al., the optical systems disclosed by the Applicant take the **integrated approach** by using an array of **zone plate modulators**. A zone plate modulator is capable to perform two functions in a single device: *focusing* the light and *modulating* the output intensity. A zone plate modulator (or an array of it) replaces the discrete elements of individually selectable sources, focusing elements, and the imaging/relay lens as taught by Gil et al.

This distinction is submitted to be of patentable merit over Gil et al under Section 103 because the synergy of this **integrated approach** in the optical

systems by the Applicant overcomes/solves many problems presented in prior art:

- By replacing all the discrete elements of individually selectable sources, focusing elements, and image/rely lens with an integrated zone plate modulator (or an array of it), the size of the optical system is greatly reduced, just as what Integrated Circuit did to the discrete transistors.
- Because a zone plate modulator integrates the focusing and modulating function into a single device, there is no need for aligning the source to the focusing elements, therefore eliminating the imaging/relay lens. As a result, the optical system requires fewer components reducing the system complexity and cost.
- The approach by Gil et al. used discrete elements of individually selectable sources, focusing elements, and image/rely lens. Such a configuration requires precise mechanical alignment from the source to the focusing elements. Therefore it is highly susceptible to environmental effects such as temperature changes, and mechanical vibrations. In contrast, the zone plate modulator is compact device made on a silicon wafer using the standard IC fabrication process. It is a

focusing lens and a modulator in one device without any adjustable or alignable components. Therefore it greatly improves the stability and durability of the optical system against environmental effects.

- By eliminating the imaging/relay lens, and by integrating the focusing function and the modulating function into a single device, the overall optical efficiency of the Applicant's systems is substantially higher than the ones by Gil et al.

These results are vastly superior to the prior art, and are not expected, nor suggested by the prior art.

The Applicant submits that the novel physical structures of the Claims 1-3, 6-9, 13, 17, 19, 22, 24, 27-31, 36-37, 39-40, 42, 45-46, 48-49, 51, 53-54 are unobvious and hence patentable under Section 103 since they produce new and unexpected results over Gil et al. The novel physical structures of the applicant's system which produce these differences are, as stated, positively recited in the independent claims 1, 17, 27, and 45. Reconsideration of this rejection is requested.

Conclusion

For all the above reasons, the Applicant submits that the specification and claims are now in proper form, and the claims all define patentably over the prior art because that the present invention contains limitations and elements not disclosed by the prior art, and that the present invention provides results that were unexpected and are superior to the prior art. Therefore, the Application submits that this application is in condition for allowance. Notice of Allowance is requested.

Conditional request for constructive assistance

The Applicant has amended the specification and claims of this application so that they are proper, definite, and define novel structure which is also unobvious. If, for any reason that this application is not believed to be in full condition for allowance, the Applicant respectfully requests the constructive assistance and suggestions of the examiner pursuant to M.P. E. P. §2173.02 and §707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

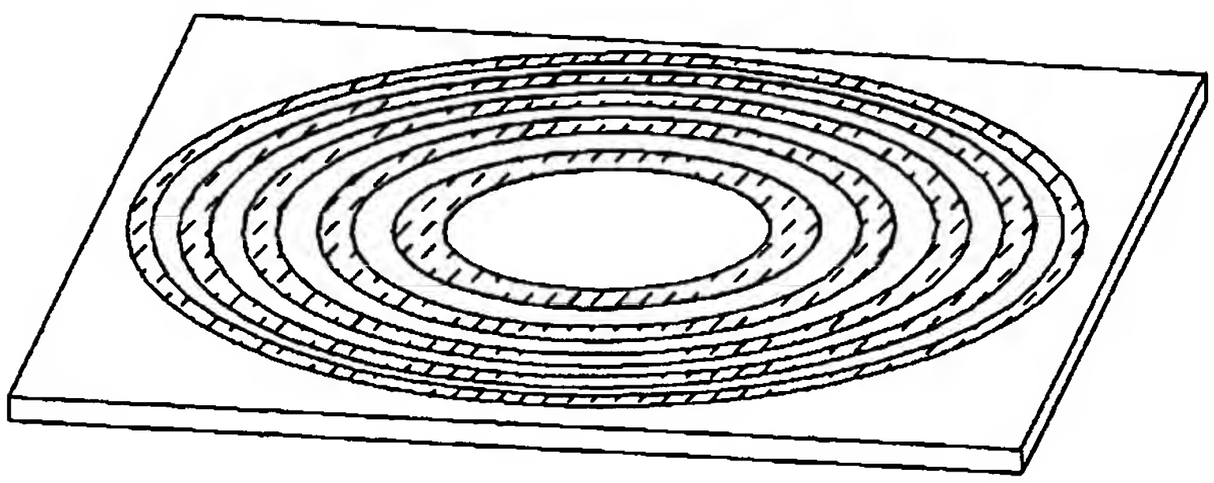

Figure 1. A Fresnel zone plate is *a static lens*. It can only focus incoming beams.

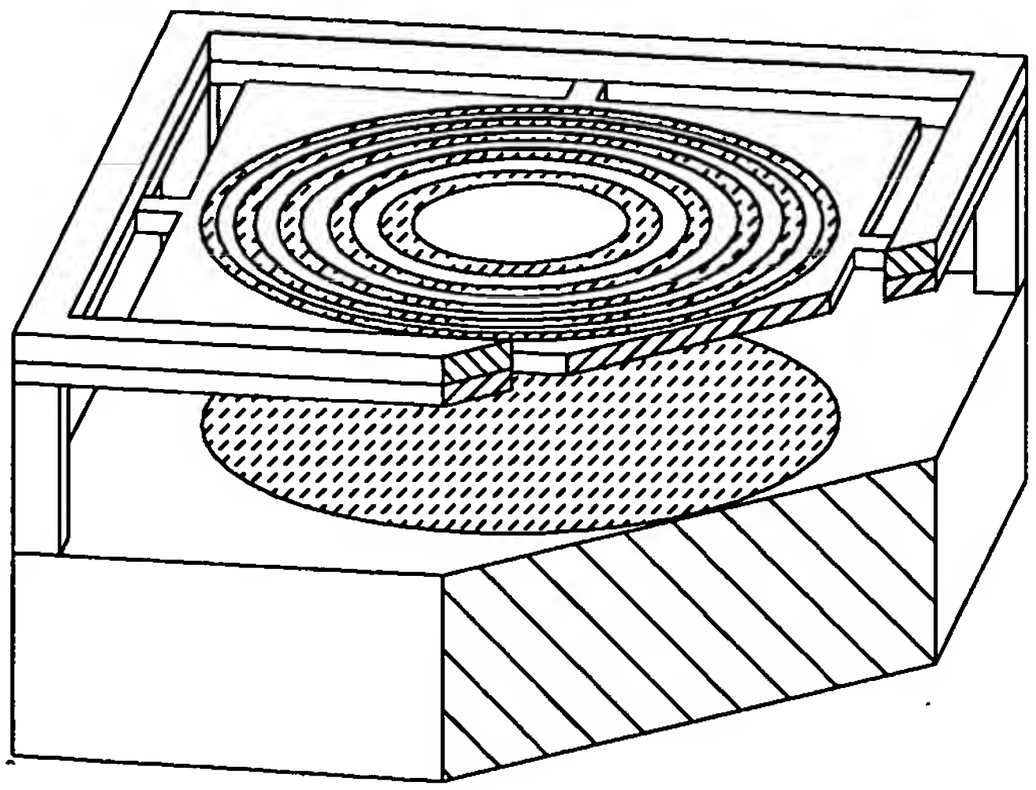

Figure 2. A zone plate modulator is *a dynamic device*. It is a unique spatial light modulator that is capable of both modulating and focusing incoming beams.

Very respectfully,

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Date: 2006 January 4

Inventor's Signature: Baokang Bi